

1.100,614



# PATENT SPECIFICATION

DRAWINGS ATTACHED

1.100,614

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## COMPLETE SPECIFICATION

### Improvements in or relating to Encapsulated Electrolytic Capacitors

We, P. R. MALLORY CO. INC., a Company incorporated under the laws of the State of Delaware, United States of America, of Indianapolis, Indiana, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to solid electrolytic capacitors and more particularly relates to means and methods for providing a hermetic seal for solid electrolytic capacitors by encapsulation.

Solid tantalum capacitors are known to be moisture sensitive, and many applications require the capacitors to be hermetically sealed in order to obtain high accuracy and good reproducibility. It is currently known in the art to provide hermetic seals for cylindrical solid tantalum capacitors by soldering a tantalum anode into a metal case, said case serving as a cathode. A preformed glass or ceramic to metal seal is slipped over the anode lead and soldered to the case and the anode lead. There are further means known to provide hermetic seals for noncylindrical solid tantalum capacitors, however, there are problems in reproducibility. While the current means provides a satisfactory seal for cylindrical capacitors, and a fair hermetic seal for noncylindrical solid tantalum capacitors, a long standing need has existed for means and methods of economically producing a hermetically sealed cylindrical solid tantalum capacitor, and further to provide good hermetic seals for noncylindrical solid tantalum capacitors.

According to the present invention there is provided an electrolytic capacitor comprising an anode structure and a surrounding cathode separated from the anode by an electrolyte, in which the capacitor is sealed against the ingress of moisture by a non-permeable glass sealant moulded integrally with said capacitor.

In carrying out the invention it may be arranged that the non-permeable glass sealant is glass-bonded mica.

In one arrangement according to the invention the electrolytic capacitor may comprise an anode with an anode riser, said anode having a dielectric film thereon with a solid electrolyte layer over-lying said film, a cathode layer of electrically conductive thermosetting material substantially surrounding said electrolyte layer, the assembly being sealed against the ingress of moisture by a mass of glass bonded mica.

Some exemplary embodiments will now be described with reference to the accompanying drawing, in which:

FIGURE 1 is a sectional view of a glass-bonded mica tantalum capacitor.

FIGURE 2 is a sectional view of a tantalum capacitor with a glass-bonded mica end seal.

Generally speaking, the present invention provides the means and methods for hermetically sealing a solid tantalum capacitor with glass-bonded mica in a one-step moulding operation. Theoretically, tantalum capacitors cannot withstand the temperatures used in moulding glass-bonded mica, and prior attempts have been made to utilize current plastic technology. However, it is not possible to obtain hermetic seals with plastic alone. The present invention consists of coating the tantalum anode with a conductive material capable of withstanding moulding temperatures which serves as the cathode, attaching the cathode lead, with any material capable of withstanding the moulding temperature, placing the capacitor into a suitable mould cavity and moulding the capacitor with glass-bonded mica. This process simplifies the obtaining of hermetic seals, thus substantially lowering production costs. It further provides a solid tantalum capacitor with improved thermal characteristics, and a superior hermetic seal.

Figure 1 is a sectional view of the glass-

[Price 4s. 6d.]

bonded mica solid tantalum capacitor 10 wherein the tantalum anode 11 is coated with a conductive thermosetting material such as silver epoxy 12 which serves as the cathode. Cathode lead 13 is attached to cathode 12 at point 14 by epoxy 12, and anode lead 15 is attached to anode riser 16 at weld 17. Capacitor 10 is then placed in a suitable mould cavity and is moulded with glass-bonded mica 18. End projections 19 and 20 further insure the seal.

Figure 2 is a sectional view of modified embodiment of the present invention wherein tantalum anode is bonded to the cathode can 22 by a layer of a conductive thermosetting material such as silver epoxy 23. Anode lead 24 is welded to anode riser at point 26, and cathode lead is attached to cathode can 22 at point 28. A glass-bonded mica end seal 29 is then moulded thus providing a hermetic seal for capacitor 30.

In the moulding operation, any mouldable glass or ceramic which will mould as a non-permeable material can be used, however, most ceramics require sintering after they are moulded. Glass bonded mica is preferable as it does not require post sintering. This process can also be utilized for moulding solid aluminium, zirconium and the like capacitors.

The encapsulated capacitor of the present invention as herein described is merely illustrative and not exhaustive in scope. For instance, the method of attaching the cathode lead may be accomplished by any material which will withstand the moulding conditions without melting and flowing. This includes spray metals having a sufficiently high melting point such as bronze, and welding the cathode lead thereto. Although silver epoxy was used as an illustrative example for the cathode, any thermosetting conductive material which will withstand moulding conditions may be used. Further, while the drawings illustrate a cylindrical capacitor, this method is particularly applicable to any noncylindrical units as rectangular units. It is further applicable to solid capacitors consisting of the group including titanium, tantalum, zirconium, aluminum and niobium and the anode could be constructed from a porous film forming metal. Since many widely different embodiments of the invention may be made without departing from the scope thereof which will be readily apparent to those skilled in the art, it is intended that all matter contained in the above description and shown in the accompanying drawings shall be interpreted as illustrative and not in a limited sense.

#### WHAT WE CLAIM IS:—

1. An electrolytic capacitor comprising an anode structure and a surrounding cathode separated from the anode by an electrolyte, in which the capacitor is sealed against the

ingress of moisture by a non-permeable, glass sealant moulded integrally with said capacitor.

2. An electrolytic capacitor as claimed in claim 1, in which the non-permeable, glass sealant is glass bonded mica.

3. An electrolytic capacitor as claimed in claim 2, in which the anode structure includes an anode with an anode riser, said anode having a dielectric film thereon, with a solid electrolyte layer overlying said film, a cathode layer of electrically conductive thermosetting material substantially surrounding said electrolyte layer, the assembly being sealed against the ingress of moisture by a mass of glass bonded mica.

4. An electrolytic capacitor as claimed in claim 3 in which the anode is of film forming metal.

5. An electrolytic capacitor as claimed in claim 4 in which the film forming metal is selected from the elements titanium, tantalum, zirconium, aluminium and niobium.

6. An electrolytic capacitor as claimed in any of claims 3 to 5, in which the electrically conductive, thermosetting material is epoxy resin.

7. An electrolytic capacitor as claimed in any of claims 3 to 6, in which a mass of glass bonded mica is intimately moulded about said cathode layer to hermetically seal said device within a single unitary encapsulated body thereof, with a cathode lead projecting from said cathode layer and an anode lead projecting from said anode riser, said anode and cathode leads extending through said glass bonded mica.

8. An electrolytic capacitor as claimed in any of claims 3 to 6, in which the cathode layer is surrounded by, and is in contact with an electrically conductive can having an open end, said can forming a cathode connection, a mass of glass bonded mica enclosing the open end of the can to hermetically seal the capacitor, with an anode lead projecting from said anode riser and extending through said glass bonded mica.

9. An electrolytic capacitor as claimed in claim 7 or claim 8, in which the mass of glass bonded mica has an end projection which surrounds a predetermined length of said lead or leads beyond the general boundary of said mass for further ensuring said hermetic seal.

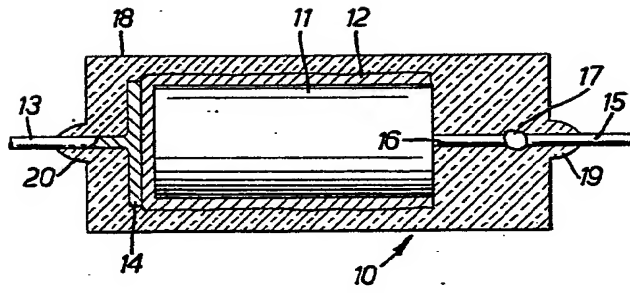
10. An electrolytic capacitor as claimed in any of claims 3 to 9, in which the anode is cylindrical with a first extremity having an anode riser, and in which the dielectric film and the cathode layer overlie the curved periphery and a second extremity of the cylindrical anode.

11. An electrolytic capacitor as claimed in any of claims 3 to 10, having a porous anode of film forming material.

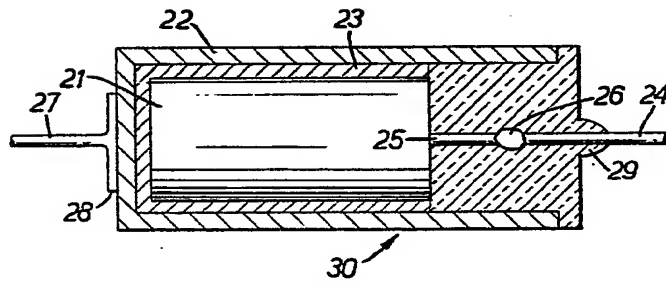
12. An electrolytic capacitor substantially as hereinbefore described with reference to the accompanying drawing.

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**FIG. 1.**



**FIG. 2.**